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A systematic search and critical review of measures of disability for use in a population survey of hand osteoarthritis (OA)[1]

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Summary

Objective: In order to develop a hand assessment questionnaire for a population survey, a systematic review was undertaken of measures of hand disability. The purpose of this review was to identify valid measures to evaluate hand osteoarthritis (HOA) in the general population and primary care and to perform a quality appraisal of them.

Method: Measurement tools were identified from an online search of databases (Medline, CINAHL and Institute for Scientific Information (ISI), 1990–2002) restricted to English language and adult population. Search terms combined "osteoarthritis" and "arthritis" with "hand" and ["function" or "disability" or "outcome"]. Instruments used in the evaluation of HOA were identified following application of strict eligibility criteria. The use of these tools in HOA was rated by pairs of independent reviewers according to criteria developed by the Medical Outcomes Trust.

Results: The initial search yielded a list of articles which were not mutually exclusive (ISI, 127; Medline, 64; CINAHL, 61). Full journal articles were ordered from relevant abstracts (ISI, 28; Medline, 3; CINAHL, 5). Further hand searching of articles produced an additional 34 references. A total of 61 references were identified, 18 measurement tools, 5 of which met the inclusion criteria [Algofunctional Index (FIHOA), Arthritis Impact Measurement Scale 2 (AIMS2), Stanford Health Assessment Questionnaire (HAQ), Australian/Canadian Osteoarthritis Hand Index (AUSCAN), Cochin]. Overall, the AIMS2 and AUSCAN were more highly rated than the FIHOA, Cochin and HAQ.

Conclusions: The aim of this review was not to recommend any one instrument over another but to provide an overall summary of the robustness of commonly used measures. The choice of instrument will depend on many factors, and will differ from project to project depending on the question asked.

Key words: Systematic review, Hand osteoarthritis, Disability measures.

Introduction

Osteoarthritis (OA) is common in older people and often affects the hip, knee and hand[1]. It is a cause of pain, stiffness and disability, and limits activities of daily life[2]. The impact of arthritis can be measured within dimensions as defined by the WHO ICF[3], disability (activity limitation) being frequently measured because of its importance to patients and the lack of measures of participation (formerly handicap). An overview of measurement of health status in arthritis patients carried out in 1993 by Jacobs *et al.*[4] listed 12 arthritis specific measures and assessed three dimensions of health: function, psychosocial and social. The two most commonly used instruments were the Stanford Health Assessment Questionnaire (HAQ) and the Arthritis Impact Measurement Scales (AIMS). The AIMS covered all three dimensions, the HAQ two (function and social).

There have been few community studies of the extent of disability caused by symptomatic hand OA (HOA) in older people[5], although the effects of limitation on quality of activities of daily living (ADL) may be considerable[6]. Population studies of hip and knee OA use disease and region-specific measures to evaluate pain and disability, e.g., Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)[7,8]. However, no such widely accepted measure is recognised in HOA. The advantage of having a common measure in population studies is that it allows for comparability of data across populations.

In order to develop a hand assessment questionnaire for a population survey, a systematic review was undertaken of measures of hand disability. The purpose of this review was to identify current valid measures to evaluate HOA in the general population and primary care and to perform a quality appraisal of such instruments.

Methods

A three-stage strategy was used. Stage 1 involved identifying relevant articles using a systematic search (where more than one article might identify a particular

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instrument). Stage 2 identified eligible instruments from the articles in stage 1 for inclusion in the critical review. Stage 3 applied established review criteria to these instruments.

STAGE 1: SELECTING THE PAPERS

Search strategy

A systematic search strategy was developed. Publications were retrieved by an online electronic search of databases (Medline, CINAHL and Institute for Scientific Information (ISI), 1990–2002) in the English language and adult population. All papers published until December 2002 were eligible for inclusion in the review. Search terms combined: "osteoarthritis" and "arthritis" with "hand" and ["function" or "disability" or "outcome"]. The initial search yielded the following articles from the respective databases: ISI (127), Medline (64) and CINAHL (61). Selection criteria (see below) were applied to these abstracts and full papers were retrieved if the abstract provided insufficient information to enable selection. From abstracts and application of inclusion and exclusion criteria, full journal articles were ordered (ISI, 28; Medline, 3; CINAHL, 5) (ISI: Refs.[1,9–35], Medline: Refs.[36–38], CINAHL: Refs.[39–43]). References of all identified articles were hand searched for additional potentially relevant publications which produced an additional 30 articles plus 4 abstracts (articles: Refs.[4,44–72], abstracts: Refs.[73–76]).

Selection criteria

Articles were included in stage 1 if the following conditions were met: published studies encompassing patient assessed evaluation of functional disability in populations with HOA (1990–2002) or published articles referring to development or testing of patient assessed measures of functional disability applied in HOA (1990–2002). Exclusion criteria for stage 1 were: articles not specific to the evaluation of patient assessed hand disability in OA; non-English language articles; development, testing or use of laboratory radiographic and imaging techniques or objective measures of hand disability; articles which did not describe the instrument in sufficient detail; non-published data; narrative reviews; single item measures; and generic measurement tools.

STAGE 2: SELECTING THE INSTRUMENTS

Quality assessment

In order to confirm eligibility of disability measures, inclusion and exclusion criteria were applied to the identified instruments. This necessitated a further database search by named instrument. The inclusion criteria for stage 2 were: the tool was a published (anglicised) patient assessed functional disability measure and had been applied in the evaluation of HOA. Exclusion criteria for stage 2 were: an instrument used only in relation to other hand conditions, e.g., carpal tunnel syndrome or other types of arthritis such as rheumatoid arthritis (RA); assessment based on objective measures of hand disability (laboratory, radiographic and imaging techniques); instruments not clearly identified in published texts; instruments not described in sufficient detail to allow quality assessments[77]; measures not evaluating patient assessed hand disability in OA; instruments only used in auditing outcome following surgery or trauma; non-English language articles.

STAGE 3: ASSESSING THE INSTRUMENTS

Review criteria

Systematic reviewing of outcome measures has been performed previously, for example in the area of adult critical care[78]. However, the criteria for systematically reviewing outcome measurements are not as well developed as those used for randomised controlled trials (RCTs). To evaluate how valid, reliable and appropriate the disability measures defined by the systematic search were, we adopted the review criteria used by Coons *et al.*[77], published by Lohr *et al.*[79], and developed by the Scientific Advisory Committee of the Medical Outcomes Trust. The review criteria (Appendix 1) consisted of: conceptual and measurement model; reliability; validity; respondent and administrative burden; alternate forms; and cultural and language adaptations. For the purpose of this review, which was to identify measures for general population surveys, we additionally considered if the measurement tool was self-administered, if it had been used previously in populations with HOA, and whether the tool was a relevant measure for population-based studies. The review also evaluated each instrument according to the Outcome Measures in Rheumatology (OMERACT) group filter for outcome measures[80]. The review did not seek to assess if a particular instrument had been used as a primary outcome measure in RCTs, but its use in trials was reported if identified. Each instrument was reviewed by two out of the three reviewers, working independently of each other. KD reviewed all papers with ET or EMH acting as the second reviewer. Agreement was achieved through consensus meetings. For each criterion reviewed, the adequacy of supporting evidence was rated as extensive (+++), adequate (++), limited (+), none (0) and unknown (?).

Results

STAGE 1

A total of 61 references were used to identify the measurement tools. Following the application of the stage 1 inclusion/exclusion criteria to these articles, 18 measurement tools were identified: the Michigan Hand Outcomes Questionnaire (MHOQ)[15,16], the Disabilities of the Arm Shoulder and Hand (DASH)[32,45,49,50,70], the Arthritis Impact Measurement Scales 1 and 2 (AIMS1/AIMS2)[62], the HAQ[72], the Algofunctional Index (FIHOA)[20,21,31], the Disability Schedule of Function (DSF)[42], the Upper Extremity Function Scale (UEFS)[38,65], the Brigham and Women's Hospitals' Carpal Tunnel Questionnaire (BWH CTQ)[9,10,53], the ADL and visual analogue scale (VAS) Quality of Life Hand questionnaire (ADL/VAS QOL Hand Q)[17], the Australian/Canadian Osteoarthritis Hand Index (AUSCAN)[12,13,29,74], the Musculoskeletal Functional Assessment Questionnaire (MFAQ)[46,57,58,69], the Instrument of Activities of Daily Living (IADL)[63], the Cochin scale[22,33], the Ghent functional index[31,71], the Hand Clinic Questionnaire (HCQ)[68], the Patient Evaluation Measure (PEM)[56,68], the Hand Outcome Survey Sheet (HOSS)[68] and the Hand Injury Severity Scoring System (HISS)[44,68].

STAGE 2

Following a further database search and application of the stage 2 inclusion/exclusion criteria five instruments were eligible for the critical review: the HAQ[72], AIMS[62],

AUSCAN[12,13], the Cochin scale[22,33] and FIHOA[20,21]. The most frequent reasons for exclusion were because the measure (1) had not been used to evaluate hand disability in OA (UEFS[38,65], BWH CTQ[9,10,53], MFAQ[46,57,58,69], IADL[63], HCQ[68], PEM[56,68], HOSS[68] and HISS[44,68]), and (2) was not described in sufficient detail to allow quality assessment (DSF[42], ADL/VAS QOL Hand Q[17], Ghent functional index[31,71]). The MHOQ[15,16] was excluded following communication with the authors because it had not been tested in HOA. The DASH[32,45,49,50] was excluded as there was no clear evidence for its use in HOA other than in auditing outcome following hand surgery[70].

STAGE 3

A narrative review of the HAQ, AIMS, AUSCAN, Cochin and FIHOA, supported by references identified using the further database search by named instrument, is detailed below.

HEALTH ASSESSMENT QUESTIONNAIRE

Background

The HAQ Disability Index (DI) was developed as part of a comprehensive assessment of outcome in arthritis covering multidimensional areas including death, discomfort, disability, drug and therapeutic costs, toxicity and dollar costs[81]. The DI section of the full HAQ is normally referred to as the 'HAQ'. Pincus *et al.*[82] reported on a modified HAQ (MHAQ) with added areas such as patient satisfaction and change in degree of difficulty. Baron *et al.*[83] developed an upper extremity HAQ score (HAQUP) which used the mean score of dressing and grooming, eating, reach and grip. The same version is referred to as the upper limb HAQ (ULHAQ)[84]. Pincus *et al.*[85] developed components of the HAQ to overcome the 'floor effects' of the HAQ and MHAQ[86,87] and produced a new Multidimensional HAQ (MDHAQ) for use in all types of arthritis.

Conceptual framework

The HAQ was conceptualised by Fries *et al.*[81] as an instrument covering outcomes important to patients. Its multidimensionality gave a meaningful way of measuring a number of domains without combining them into a single score. The physical component was divided into nine domains (with sub-scales); dressing (3), arising (1), eating (2), walking (1), hygiene (4), reach (2), grip (3), outside activity (2) and sex (1). Each question could be answered on a scale ranging from 'without difficulty' = 0, 'with difficulty' = 1, 'with some help from another person or device' = 2 or 'unable to do' = 3. The highest score on any sub-scale within a domain was the score for that domain. The total score was derived by adding up the scale scores and dividing by the number of questions answered[81]. The HAQ was further refined and is described in Fries *et al.*[88]. A more recent version of the HAQ[89] is described in Table I. The HAQ has been used in long-term prospective hospital based studies of OA patients[19].

The MHAQ uses one question from each category (8/20) with additional questions covering areas of importance[82]. The MDHAQ version incorporates six advanced ADL items, four items on psychological distress, VASs for pain and fatigue, and the Rheumatoid Attitudes Index[85]. The CLINHAQ is a version using the original HAQ and additional items, e.g., pain diagram, for use in clinic but that addresses a series of domains not covered by HAQ[90].

Reliability

For the HAQ, test–retest correlations in arthritis have ranged from 0.87 to 0.96[89]. One-month test–retest for the HAQ showed a correlation coefficient of 0.78, and for the MHAQ in adults with various rheumatic diseases, 0.91[82]. Spearman correlations between interview and self-complete formats ranged from 0.85 to 0.94[89]. The reliability of the HAQUP/ULHAQ has not yet been studied separately[84].

Validity

Simulation of activities in comparison with the self-completed HAQ has been used for validation purposes[81]. The HAQ and AIMS correlated well with each other (0.91, $P < 0.01$) and OA patients tended to have mean lower scores than RA patients. When assessing sensitivity to change for HOA in RCTs, it has been difficult to determine whether the HAQ was not sensitive or if the trial was underpowered[24,91–93]. Construct validity of the HAQ was assessed and found to be valid in a UK population survey of self-reported RA, OA and other arthritides[94].

Formal validation studies of the HAQUP/ULHAQ have not been performed *per se*[84]. However, pain severity in older people with HOA was found to correlate with upper limb disability measured by the HAQUP, but not hand function tested objectively[83]. The HAQUP did not correlate well with the Smith hand function test but did with strength, pain and tenderness.

Respondent and administrative burden

Self-administration of the HAQ takes 5–8 min and can be manually scored in less than 1 min[88,89] (Table I). The MDHAQ is completed in 10–15 min in clinic[85].

Alternate forms

The HAQ has been developed for use as a self-, interviewer-, and telephone-administered instrument.

Cultural and language adaptations

The HAQ was developed in English (USA). An anglicised version has been developed and tested in RA patients[52]. There are a number of available translations[18,95,96]. Although there are a number of translations of the HAQ and its modifications, there has been concern over the lack of consistency in development and scoring of some of these versions[95].

Relevance to populations with HOA in primary care

The MHAQ has been used in a UK population survey of 6000 people of all ages. This survey of musculoskeletal complaints included older people with hand pain defined as pain in the past month lasting more than a week[35]. The score was modified from that suggested by the authors[82] to that used for the original HAQ (0–3). MHAQ was not fully completed by 11.4% responders. Upper limb symptoms (including shoulder pain) scored less global disability on the MHAQ compared with other musculoskeletal symptoms. Disability levels rose with age and were especially high in the over 75-year olds.

Table I
Description of comparative properties of instruments

Tool (year and country of development)	Summary of the instrument	Number of items	Content of items	Scoring method	Time to complete
HAQ (1980, USA)	Disability index developed as an assessment of outcome in arthritis	20 questions in 8 domains of function	Functional domains include: dressing, arising, eating, walking, hygiene, reach, grip, activities	Each question rated from 0 (no difficulty)–3 (unable to do). The highest sub-scale score in each domain determines the score for that domain, unless assistance or devices are used, where the category score is then adjusted to the lower score or 2 (with much difficulty or limited). Total score for the HAQ is the mean of the scores of 8 categories on a continuous scale 0–3	Self-administration of the HAQ takes 5–8 min and manually scored in less than 1 min
AIMS1/2 (1980, USA)	Developed as a multidimensional index to measure health status of individuals suffering from various arthritic conditions	56-item tool, 9 dimensions	Dimensions include: mobility, physical activity, dexterity, activities of daily living, social role, social activity, anxiety, depression and pain	Responses for the items for each scale standardised to 2 sets of 5 response options (all days–no days; always, never or always, never), AIMS2 has 4 or 5 items for each scale	AIMS takes approximately 20 min to self-administer; AIMS2 on average 23 min. AIMS hand and finger function sub-scales, arm function sub-scales substantially shorter
FIHOA (1993, France)	Specific tool for evaluating and monitoring symptoms and functional repercussions in hand osteoarthritis	10 questions	Assessing functional impact. Includes daily fine tasks involving the hand	Each task asks: 'Can you?' and is answered: 'Possible without difficulty' (scores 0), 'possible with difficulty' (scores 1) or 'impossible' (scores 2). An individual may have a score between 0 and 20 on the index. Modified version reports same questions. Amended scoring schedule: items rated on a 4 point scale: 'possible with difficulty' is divided into: 'possible without difficulty' and 'possible with slight difficulty': scale 0, 1, 2, 3. An individual may have a score between 0 and 30 on the modified index	Interviewer-administered mean time of 2.35 min (SD = 2 min)
Cochin (1996, France)	Practical functional disability scale. Originally developed for rheumatoid arthritis. Since been evaluated in hand osteoarthritis	18 questions on activities of daily living for the hands	Assesses activities, in the kitchen, in dressing, hygiene, at the office and 'other'	Each question answered on a 6 point Likert scale from 0 (done without difficulty) to 5 (impossible to do). Total score derived by adding the score of each question. Total score ranged from 0 to 90	Interviewer administered. Time of completion: less than 3 min
AUSCAN (1997, Australia and Canada)	Captures combination of common symptoms in hand osteoarthritis: pain, stiffness and physical functioning	15 items: pain (5) stiffness (1) physical functioning (9)	Assesses: Pain during activities e.g., pain at rest, pain when gripping objects: hand function relating to difficulty with hand activities (e.g., taps, jars, carrying pots): One question on severity of morning stiffness in the last 48 h	For the Likert version (AUSCAN LK 3.0), responses are scaled on a 5 point Likert scale (0 = none to 4 = extreme) with sub-scale scores calculated by summing up the scores of the individual components. The possible range of scores is 0–20 for pain, 0–36 for function, and 0–4 for stiffness. The authors also suggest an overall score generated by totalling the three sub-scale scores, which ranges from 0 to 60. For the AUSCAN VA 3.0, items are scored on a 0–100 visual analogue scale; 0–500 for pain, 0–900 for function, and 0–100 for stiffness	Instrument is self-completed, though no details on time taken for completion

ARTHRITIS IMPACT MEASUREMENT SCALES

Background

Meenan *et al.*[59] introduced the AIMS, a multidimensional health status questionnaire, for use in sufferers of arthritis. The main objective of this 56-item tool was to expand on the current outcome measures that focussed mainly on the impact of symptoms on physical health. It did this by assessing nine dimensions (mobility, physical activity, dexterity, ADL, social role, social activity, anxiety, depression, and pain). Later work developed short-form versions (SF AIMS)[97,98], a version adapted for use in elderly subjects (GERI AIMS)[99], and subsequently a revised and expanded version (AIMS2)[48,62,67].

Conceptual framework

The AIMS was developed in the United States as a multidimensional index to measure the health status of individuals suffering from various arthritic conditions[59]. It incorporated measures of mental and social well-being in addition to the usual assessment of physical health. The AIMS was a combination of two previously tested health status measures: Bush's Index of Well-being[100] and the Rand Health Insurance Study Batteries[101], that addressed concepts under the areas of mobility, physical activity, social activity, anxiety and depression. Scales were added to cover such areas as ADL, the social role, pain, and dexterity[59]. The content was devised with ''physician importance'' areas, and although patients were not involved in the original development, the tool has subsequently been shown to cover areas felt to be important for patients[48,62].

The original AIMS has been revised and expanded (AIMS2) with the main objectives of better addressing arthritis relevant aspects and to address the importance of patient satisfaction[63]. This new version was subjected to validity and reliability tests and was seen to perform as well as the original AIMS[63].

Reliability

Internal consistency estimates for the AIMS scales were 0.63 or higher in the first examination of the tool where it was applied to 100 secondary care patients presenting with a mix of arthritic conditions[59]. Reliability estimates were also calculated across sub-groups differing in age, race, gender, income, diagnosis (RA, OA, systemic lupus erythematoso, and seronegative inflammatory arthritis), and functional ability (classes I and II, classes III and IV) with the set criteria for acceptance (Cronbach's alpha > 0.7) being achieved almost 90% of the time[60]. Test–retest correlations were high across all scales (mean $= 0.87$)[61]. The measurement performance of the AIMS2[62] was assessed in 408 patients, of which 109 had OA. The arm function, and the hand and finger function sub-scales performed well both in terms of test–retest (0.92, 0.94) and internal consistency (0.74, 0.87).

Validity

AIMS scores were shown to correlate well with external measures such as overall health status, functional activity and disease activity (both patient and physician reported)[59]. In a pilot study of the AIMS2, 96% of subjects said that the scales reflected nearly all the areas of importance and 58% felt the scoring was at least satisfactory[62].

In comparison with AIMS2 hand and finger function sub-scales in RA patients, OA patients rated their hand problems as less a priority on self-designation of priority areas for improvement[62]. Mason *et al.*[102] demonstrated that the scores for components of upper extremity function, effect, and social factors were equivalent in both OA and RA patients. However, differences between RA and OA patients occurred in the symptom component, where pain was more strongly associated with physical activity in OA than in RA[102].

The GERI AIMS dexterity scale (yes/no scores) demonstrated discriminate validity for three groups of subjects: independent living (mean $= 1.37$, SD $= 2.09$), homebound (mean $= 3.51$, SD $= 3.89$) and institutionalised (mean $= 2.13$, SD $= 2.70$)[23].

Respondent and administrative burden

The AIMS takes approximately 20 min to self-administer and the AIMS2, on average, 23 min (Table I).

Alternate forms

The AIMS was designed to be used as a self-administered tool to be completed either in a clinical setting (i.e., waiting room) or at home, to be mailed back to the research centre. Literature is not available to evaluate the instrument when other modes of administration have been applied.

Cultural and language adaptations

In addition to the UK English versions[48], the AIMS/AIMS2 has been translated into other languages[103–111]. In addition, a French version of the long-form AIMS2 is available and a Delphi technique and the Nominal Group Process were used to derive a short-form version of the AIMS2 in French[47].

Relevance to populations with HOA in primary care

Although the AIMS2 has been used in a variety of settings in the USA, including with OA sufferers, there is no evidence for its use in UK OA subjects in either primary care- or population-based studies. The AIMS2 upper limb sub-scales do not require any modification from American to the English language and so have the potential for being useful in primary care- or population-based studies in the UK.

THE AUSTRALIAN/CANADIAN OSTEOARTHRITIS (AUSCAN) HAND INDEX

Background

The AUSCAN[12,13,37] was developed jointly between Australia and Canada to provide a multi-cultural assessment of hand function, pain and stiffness in OA. The intention was to develop a reliable, valid and responsive self-administered questionnaire to evaluate pain, stiffness, and physical disability in trials of HOA[12]. The AUSCAN contains 15 items that capture a combination of common symptoms in HOA and those that occur frequently and are important to symptomatic individuals.

Conceptual framework

The AUSCAN development was undertaken using the same procedures to those used in the development and validation of the WOMAC[112]. Items were generated from

clinical trials, existing questionnaires (e.g., AIMS, HAQ, Convery index), opinions of clinicians (rheumatologists, orthopaedic surgeon and physiotherapists) and patient interviews. The collated items then underwent rationalisation utilising both clinical and statistical judgement criteria.

The first stage provided questions for use in patient interviews to generate an inventory[12]. Additional items were added from interviews with HOA sufferers and a large pool of items was generated. Utilising explicit exclusion criteria the item list was reduced and tested using two methods of scaling, a Likert (LK) scale and a VAS. Interviews were undertaken with 50 symptomatic individuals with a diagnosis of HOA. Questions were organised into three main categories: pain during activities (10 items), stiffness (2 items) and physical function in different types of activity (83 items). Following an initial round of interviews the physical function items were reduced to 27 and the final candidate items for the AUSCAN were based on the prevalence of the symptom, the importance and the frequency of the symptom.

The AUSCAN uses a 48-h time frame and comprises sub-scales of hand pain (5 items), hand stiffness (1 item) and hand function (9 items). Scoring methods are described in Table I.

Reliability

Test–retest (1 week) reliability, in symptomatic individuals[13] with a clinical classification of HOA, was high for both forms of the AUSCAN and for each of the three sub-scales (ICC = 0.70 to 0.90). Internal consistency, as measured by Cronbach's alpha was also high (0.90 to 0.98).

In a Tasmanian HOA family study[29] construct validity was assessed against the Dreiser index ($r = 0.76–0.96$). Test–retest reliability Cronbach's alpha was reported as 0.82–0.99[29]. In an NSAID washout trial of 44 individuals with symptomatic HOA, responsiveness was shown to be high ($P < 0.001$) for all three sub-scales and for both forms of the AUSCAN with average standardised response means over a 6-week period ranging from −0.27 to −0.84[13].

Validity

Construct validity was high ($r > 0.40$) for both forms and each sub-scale of the AUSCAN when compared to the FIHOA (original form, LK and VAS), the HAQ (disability and pain), physician assessed tenderness and severity, and patients' global assessment of pain and function[13].

Further validation of the instrument was undertaken within the cross-sectional study of HOA in Tasmanian families[29]. Kappa agreement between pain and disability (AUSCAN 3 LK 3.0 sub-scales) and presence and severity of HOA was 'poor' to 'fair'. Total pain and function scores were associated with gender, the carpometacarpal joint, and the distal interphalangeal HOA scores in both univariate and multi-variate analyses and these variables explained 17% of the variation in pain. Spearman correlation coefficients demonstrated weak to moderate associations between severity of HOA and function and pain sub-scales.

The minimum change potentially detectable (MCPD) by the AUSCAN has been reported as 1 unit and the minimum percentage change potentially detectable (MPCPD) has been reported as follows: pain 5%, stiffness 25%, physical function 2.8% and AUSCAN total index score 1.7%[113].

Respondent and administrative burden

The instrument is self-completed, although no details have been presented on the time taken for completion.

Alternate forms

The AUSCAN (LK 3.0, VAS 3.0) has been developed as a self-administered instrument[29]. There is no evidence of alternative administration approaches in the literature.

Cultural and language adaptations

The AUSCAN has been prepared and linguistically validated in English (USA), Spanish, French, German, Italian, Dutch and Norwegian[13].

Relevance to populations with HOA in primary care

The AUSCAN was used in a study primarily designed as a family study into the genetics of HOA[29]. There is no evidence for the use of the AUSCAN in unselected OA subjects in either primary care- or population-based studies.

THE COCHIN SCALE

Background

The Cochin scale was developed by Duruoz *et al.*[22] as a practical functional disability scale for RA and hand function. It is completed by the patient's physician in a clinic setting. The developers proposed that it would also be valid and reliable for sufferers of HOA and have validated it for use in OA[33]. The tool is therefore not HOA specific but for use in hand arthritis (RA/OA).

Conceptual framework

The Cochin scale comprises 18 questions on ADL for the hands (Table I). It was constructed in three stages; firstly, from hand activities collected from published indices and clinic assessments a functional scale was formulated, secondly, a provisional scale was tested, and thirdly, the final scale was developed and tested for reliability and validity with 102 RA patients[22].

Principal components analysis identified four factors accounting for 65% of the total variance[33]. These were: grip, dexterity and precision, pinch strength and pinch dexterity of the dominant hand.

Reliability

The inter-rater reliability in 41 patients with a clinical diagnosis of HOA, at an interval of 1 h, was high (ICC = 0.96) and the mean difference in scores was 0.2 (SD = 3.60).

Validity

The validity of the Cochin scale was tested in 89 HOA sufferers attending an outpatient clinic. In terms of convergent validity, the Cochin scale was shown to correlate highly with Dreiser's functional index and VAS for handicap ($r = 0.67$ to 0.87). The Cochin scale correlated less well with radiographic lesions, manual joint assessment and measures of pain and tenderness, all measures

chosen *a priori* to assess divergent validity. Cochin scale scores were shown to deteriorate over an approximate 6-month period and showed a standardised response mean of −0.26 and an effect size of −0.17. Changes in the Cochin scale compared to patient's overall assessment showed high correlation ($r = 0.47$) and the mean change in the Cochin scale was higher in those patients who self-reported they had "improved" compared to those who had "deteriorated". Individual changes in Cochin scale were highly correlated with individual changes in the outcome measures used to assess convergent validity ($r = 0.57$ to 0.65). Discriminative evidence using Spearman's correlation was $r = 0.51$ for tenderness, $r = 0.32$ for clinical impairment and $r = 0.14$ for X-ray change[33].

Respondent and administrative burden

The Cochin scale is interviewer administered with a time of completion reported as less than 3 min (Table I).

Alternate forms

The Cochin scale has only been interviewer administered for clinic based HOA patients. There is no evidence of alternative administration approaches in the literature.

Cultural and language adaptations

The Cochin scale was originally written in French and the validity/reliability testing of the instrument has been in the French language, although the scale has been translated (forward and back translation) for use in English (USA) speaking subjects, and has been published in English[22,33].

Relevance to populations with HOA in primary care

There is no evidence for the use of the Cochin scale in OA subjects in either primary care- or population-based studies.

FUNCTIONAL INDEX OF HOA

Background

Dreiser *et al.*[114] developed FIHOA for use in a clinic based RCT of HOA, as no other tool existed at that time. It was further developed for evaluation and symptomatic follow-up of patients with digital 'OA'[20]. The Index is based on questions selected by clinicians as "most appropriate" for assessing the functional impact of active digital OA and the authors claim that it is suitable for use in everyday practice. The first published version of the FIHOA can be viewed in Dreiser *et al.*[114]. The content was determined by the investigator and consists of 10 items involving daily fine tasks involving the hand. A modified version uses an amended scoring system[20].

Conceptual framework

The main aim of the FIHOA was to be a specific tool for evaluating and monitoring symptoms and functional repercussions in HOA. No information is given in any of the publications on how the 10 tasks in the questionnaire were chosen or why the specific items were included, only that the items were chosen by clinicians[114]. The original and modified versions[20] are described in Table I.

Reliability

For the FIHOA, a Cronbach's alpha coefficient of 0.85 was recorded for the questionnaire. Although the questionnaire was interviewer administered, no inter-interviewer reliability was carried out due to the small number of patients (within OA status) each interviewer saw. An intra-patient reliability was carried out with patients completing the FIHOA twice, 1 h apart. Mean difference in total score was small, Kappas for individual items ranged between 0.68 and 0.87, and ICC for total score was 0.954[20].

Validity

There is limited evidence on validity of the FIHOA, however, very clear descriptions of methods used to collect validity data are given. In an observational study, higher FIHOA scores were seen for subjects with active OA compared to those with inactive OA or no HOA[20]. The FIHOA has been used as a primary outcome measure in HOA RCTs[21]. In one RCT, FIHOA scores were shown to correlate with global pain and overall efficacy. In a second RCT, FIHOA scores were shown to change over the 6-month follow-up period with a mean standardised response of 0.58 which was more sensitive than the objective measures examined (e.g., grip strength) but not quite as sensitive as pain measured on a VAS[21]. The MCPD by the FIHOA (modified version 0−30 scale) has been reported as 1 unit and the MPCPD has been reported as 3.3%[113].

Respondent and administrative burden

The FIHOA is interviewer administered with a mean time of 2.35 min (SD = 2 min) in subjects with painful joints. The time of completion fell when administered a second time (mean difference = 23 s, SD = 56 s). All interviewers assigned a 'good' or 'very good' rating to the questionnaire for ease of use. Ninety-eight percent of the patients rated the questions as 'easy' or 'very easy' to answer. There were missing data for three subjects (3%) in those with active HOA.

Alternate forms

The FIHOA has only been interviewer administered for clinic based OA patients. There is no evidence of alternative administration approaches in the literature.

Cultural and language adaptations

The FIHOA was originally written in French and the validity/reliability testing of the instrument has been in the French language, although the index has been translated for use in English speaking subjects, and has been published in English[21].

Relevance to populations with HOA in primary care

There is no evidence for the use of the FIHOA in OA subjects in either primary care- or population-based studies.

Comparative ratings

Table II provides a summary of the level of evidence regarding each of the tools identified based on the review criteria and Table III provides a summary of the overall

Table II
Comparison of the measures of disability

Instrument	Criteria		
	Conceptual and measurement model	Reliability	Validity
HAQ	++	+	++
AIMS1/2	++	+++	+++
FIHOA	+	++	++
Cochin	++	++	++
AUSCAN	+++	+++	++

For each criterion reviewed the adequacy of supporting evidence was rated and scored for extensive (+++), adequate (++), limited (+), none (0) and unknown (?).

performance of each instrument according to the OMERACT filter.

Discussion

The purpose of this review was to systematically identify and critically appraise outcome measures for the specific purpose of assessing hand disability in a UK population survey in older people (aged 50 years and over). This paper has examined five commonly used outcome tools in the study of HOA (AIMS2, HAQ, AUSCAN, Cochin and FIHOA). Of these instruments the AIMS2 and AUSCAN were the most highly rated across the four main criteria examined, although their applicability for use in UK population surveys is unclear. The conceptual framework of the FIHOA was not adequately described, whereas the AUSCAN has more detailed evidence for this having been developed in the same format as the WOMAC[7]. The FIHOA and Cochin are interviewer administered which disadvantages these tools. To be useful for a population survey, a self-completion format needs to be validated. The AUSCAN and the FIHOA have the advantage of being specifically developed for HOA and have been recommended by OMERACT for use in clinical studies[1]. The HAQ has been widely used in UK studies of arthritis and in population surveys, demonstrating its popularity over the AIMS2. Its main disadvantage is that a hand sub-scale was not validated separately, although upper limb versions of the HAQ have been developed[83,84].

This review was performed systematically, using previously described criteria, three reviewers and well-defined objectives. It is limited by its inability to review outcome measures under development. Instruments not qualifying, e.g., the DASH, might be appropriate and should be considered for example if the focus was on outcome following surgery (e.g., Ref.[70]). Instruments not qualifying on grounds of not being adequately described in the literature at the time of the review may fulfil the criteria at a later date.

The aim of this review was not to recommend any one instrument over another but to provide an overall review of the robustness of commonly used measures. The results have shown that all five instruments performed well. The choice of instrument will depend on many factors, and will differ from project to project depending on the question asked. The potential users of these instruments should base their instrument selection decision on the characteristics that are most relevant to their particular outcome need. In selecting an instrument to use there are a number of factors that will influence choice including the population selected (patient population, older population), setting (hospital outpatient clinic, general practice surgery), mode of administration (postal questionnaire) and time constraints (use of short form or long versions).

As in the early days of systematic reviewing of RCTs, important information was often missing which hindered critical review of the instruments. It was therefore difficult to provide more than a detailed qualitative review of five instruments according to set criteria. In developing new outcome measures, consideration of the properties listed in Appendix 1 will help future reviews of this kind.

Table III
The evaluation of instruments according to the OMERACT filter

Instrument	Truth (conceptual framework/ validity)	Discrimination (sensitivity/ reliability)	Feasibility (respondent/ administrative burden, alternate forms, cultural, language adaptations)
HAQ	++	+	++
AIMS1/2	++	++	++
FIHOA	++	+++	++
Cochin	++	++	++
AUSCAN	+++	+++	++

For each OMERACT filter reviewed the adequacy of supporting evidence was rated and scored for extensive (+++), adequate (++), limited (+), none (0), and unknown (?).

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Appendix 1

Review Criteria (adapted from Refs.[77,79]).

Scoring: adequacy of supporting evidence

{ +++ extensive,
{ ++ adequate,
{ + limited,
{ none,
{ ? unknown

Conceptual and measurement model

A conceptual model is the rationale for, and description of, the concept that the measure is intending to assess and the relationships between concepts. A measurement model represents the operationalisation of the conceptual model in terms of the basic elements (e.g., Which items are combined to create scales?).

Reliability

Reliability is the degree to which an instrument is free from random error. This is estimated by examining the

extent to which similar scores are obtained with multiple replications (i.e., items, occasions, raters). Internal consistency (items, test–retest (occasions) and inter-rater (raters), reliability) are often used to estimate the reliability of the measurement process. The most common estimate of reliability reported in the literature is internal consistency. Minimum suggested internal consistency coefficients range from 0.50 to 0.70 for group comparisons, and 0.85–0.95 for individual comparisons. Kappa coefficients are also reported as an estimate of reliability that examines the proportion of responses in agreement at separate measurement points. Fleiss suggests kappa of less than 0.40 are poor, 0.40–0.59 are fair, 0.60–0.74 are good, and greater than 0.74 are excellent. According to Landis and Koch kappa of less than 0.0 are poor, 0.0–0.2 are slightly poor, 0.21–0.40 are fair, 0.41–0.60 are moderate and 0.61–0.80 are substantial, and 0.81–1 are almost perfect.

Validity

Validity is the degree to which an instrument measures what it purports to measure. Three types of evidence that support an instrument's validity are: content related, criterion related and construct related. Content validity is the extent to which a measure is judged to reflect the appropriate range and depth of content. Criterion validity is a measure of how well the instrument compares to a gold standard but is rarely tested due to the lack of widely accepted criterion measures. Construct validity is the extent to which a measure behaves as expected (e.g., it correlates in the expected or hypothesised direction and magnitude with other measures with which it should be related (convergent evidence) and with which it should not be related (discriminate evidence)). Another aspect of construct validity is the ability of an instrument to distinguish between known groups (e.g., individuals with and without a particular condition). The validity of a measure can also be supported by its responsiveness or ability to detect changes over time.

Respondent and administrative burden

Respondent burden is the time, effort and other demands placed on those who respond to the instrument. Administrative burden is the demand on those who administer the instrument.

Alternative forms

Alternative forms of an instrument include all those of administration other than the original source instrument. Evidence should be provided that supports the comparability of the alternative mode of administration with that of the original instrument.

Cultural and language adaptations

Information about methods used to achieve conceptual and linguistic equivalents of cross-culturally adapted instruments should be included. In addition, evidence should be provided that the measurement properties of the adaptation are comparable to the original instrument.

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